Biology Knowledge Organiser
Communicable Disease

Health and Disease

Health is a state of mental and physical well-being. **Diseases** are a major cause of ill-health. Other factors including diet, stress and life situations can have a profound effect on health.

Communicable Disease

Communicable diseases are infectious and are caused by tiny **microorganisms** called **pathogens**. The different types of pathogens are:

Pathogen	Description
Viruses	A virus 'hijacks' our cells. It gets inside cells and uses the host cell's resources to reproduce itself, damaging or even killing the host cell eventually.
Bacteria	A bacterium gets inside the body and releases toxins (chemicals that damage our tissues) and makes us feel ill.
Protists	A protist can release toxins and attack cells.
Fungi	A fungus can grow through and invade tissues, causing damage.

Pathogens can be spread by **direct contact**, by **water** or by **air**. General ways to prevent the spread of most pathogens include washing hands thoroughly, coughing/sneezing into tissues & disposing of them straight away as well as disinfecting surfaces.

The simplest way to prevent disease is to **stop pathogens from spreading.** Controlling the spread of disease can be done through: **good hygiene, effective sanitation** and **waste disposal.**

Common Diseases to Learn

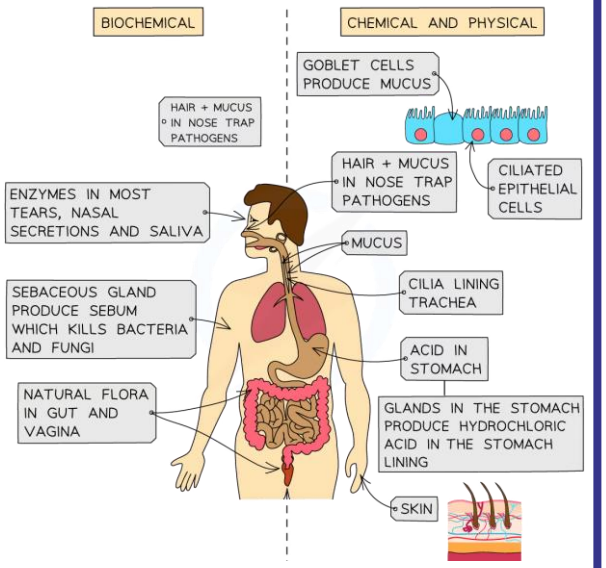
Disease	Type	Symptoms	Spread by	Prevent spread by	Treatment
Measles	**Virus**	- **Fever** - Red skin **rash**	**Inhaling droplets** from sneezes/ coughs	- **Vaccination** - Cough/sneeze into tissues	- No cure, use painkillers
HIV (leading to AIDS)	**Virus**	- HIV is initially **flu-like** - Damages immune system causing **AIDS** – where the body **can no longer fight off other dangerous diseases** which can kill.	- **Sexual Contact** - In blood when drug users share needles	- **Wearing condoms** during sex - Not sharing needles	- No cure BUT **antiretroviral drugs** can stop people from developing AIDS
Tobacco mosaic virus	**Virus**	- Affects plants - Creates a 'mosaic' **pattern of discoloration** on leaves, **stunting growth**	- **Contact with other plants**, naturally or by farmers' gloves.	- **Destroying infected plants** - Wash infected tools /gloves	- No cure, only prevention
***Salmonella* food poisoning**	**Bacteria**	- **Fever** - **Abdominal Cramps** - **Vomiting** - **Diarrhoea**	- Eating **food** prepared **unhygienically** / undercooked meat	-**Vaccinate chickens** - **Disinfect** surfaces **/wash hands** after touching raw meat.	- **Antibiotics** - Plenty of fluids
Gonorrhoea	**Bacteria**	- Thick **yellow/green discharge** from the vagina/penis - **Pain** when urinating	- **Sexual Contact**	- **Wearing condoms** during sex	- **Antibiotics**
Malaria	**Protist**	- **Fever** - Can be fatal	- Spread when **mosquitos bite** humans	- Destroying mosquito **breeding grounds** - Use **mosquito nets**	- **Antimalarial drugs**
Rose black spot	**Fungus**	- Affects leaves - **Purple/Black spots** - **Turn yellow** and drop off early, **stunting growth**	- "**Rain** splash" or **wind** spreads fungus from plant to plant	- Using **fungicides** - Destroying the affected leaves	- Using **fungicides** (chemicals that kill fungi)

Human Defences

The human body has a number of mechanisms that are the first line of defence against an infection.

The non-specific defence systems of the human body against pathogens include:

- The skin
- The nose
- The trachea and bronchi
- The stomach



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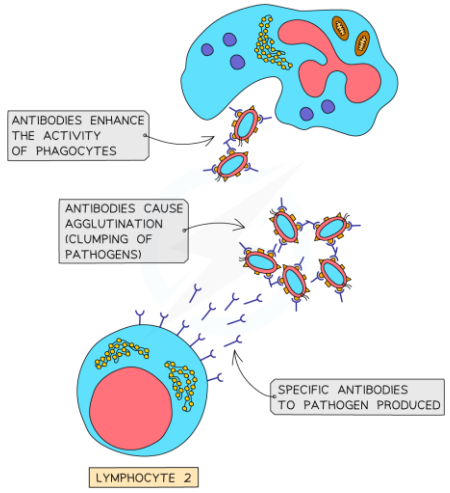
Immune system

The immune system of the body is highly complex, with white blood cells being the main component. Once a pathogen has entered the body the role of the immune system is to prevent the infectious organism from reproducing and to destroy it. White blood cells help to defend against pathogens by:

- **Phagocytosis**
- Production of **antibodies**
- Production of **antitoxins** (these are special types of antibody)

Phagocytosis

Phagocytes engulf and digest pathogens, this can be non-specific or helped by antibodies which cause **agglutination** (clumping) of pathogens. The phagocyte surrounds the pathogen and releases enzymes to digest and break it down to destroy it

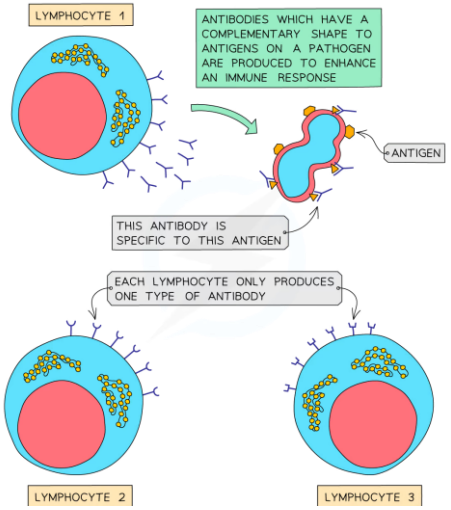


Antibodies

Lymphocytes produce antibodies. Antibodies are Y-shaped proteins – each individual has the potential to make millions of different types of antibodies, each with a slightly different shape. The aim of antibody production is to produce the antibody that is **specific** (complementary) to the **antigens** on the surface of the pathogen

- This is a specific type of immune response as the antibodies produced are specific to each pathogen's antigens

Memory cells are **lymphocytes** that remain in the body after an initial infection with a particular pathogen; they produce the specific antibodies against its antigens so that if you get infected by the same pathogen again in the future (and the antigens are the same) you can **produce antibodies** much quicker against it before its numbers increase and it can cause damage to the tissues of the body.

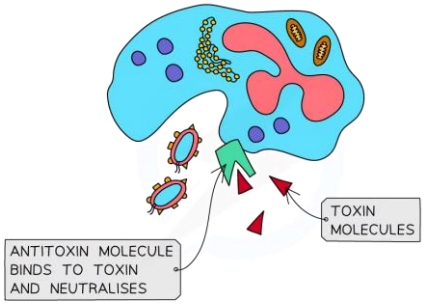


Antitoxins

Some pathogens (usually bacteria) can produce substances which act as toxins which make you feel unwell.

Lymphocytes can produce antibodies against these substances – in this case, they are called **antitoxins**.

The antitoxins neutralise the effects of the toxin



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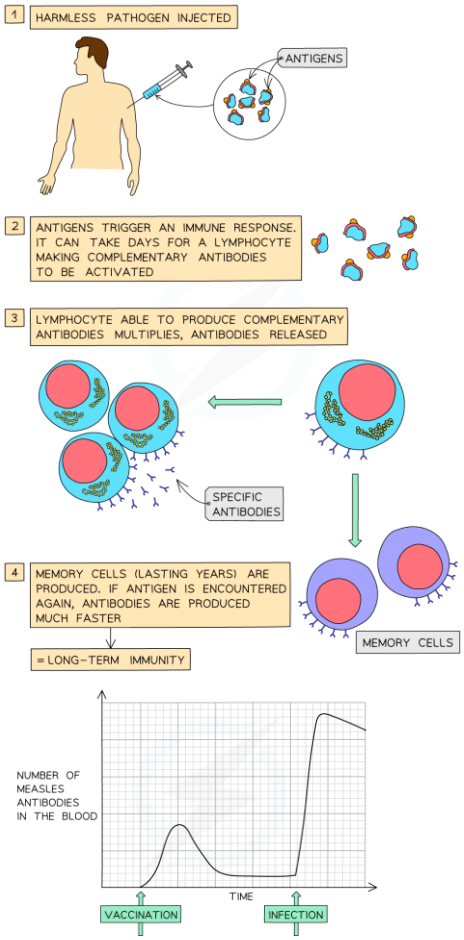
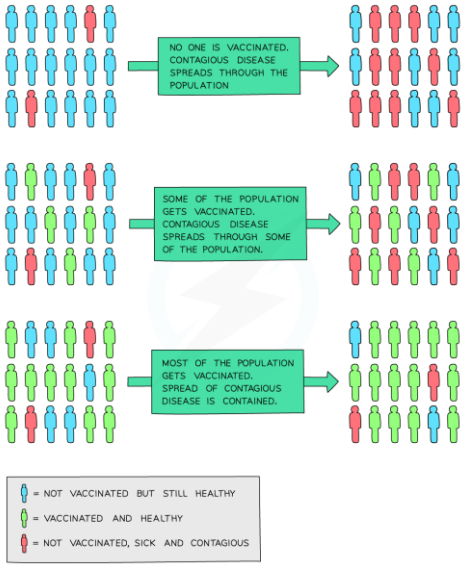
Vaccination

Vaccination involves introducing small quantities of dead or inactive forms of a pathogen into the body to stimulate the white blood cells to produce antibodies. If the same pathogen re-enters the body the white blood cells respond quickly to produce the correct antibodies, preventing infection



Herd immunity is achieved when a large enough proportion of the population is immune to the pathogen so the pathogen cannot spread.

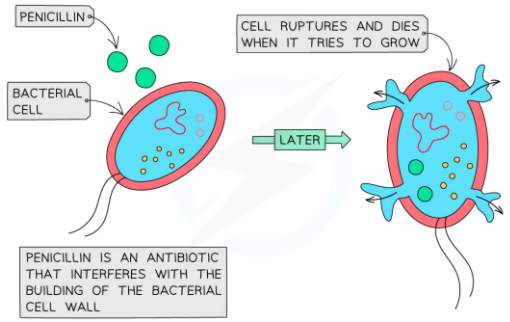


Antibiotics and Painkillers

When treating a disease there are two types of medication that an individual can take:

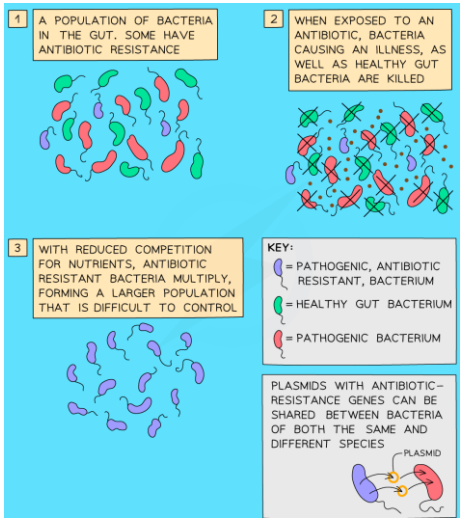
- Medicines that treat the **cause** of the disease – antibiotics
- Medicines which treat the **symptoms** of the disease – eg. painkillers

Antibiotics, such as penicillin, are medicines that help to cure bacterial disease by killing infective bacteria inside the body. Only certain antibiotics will work on certain diseases, however, so a doctor will prescribe different antibiotics depending on the type of infection



Antibiotics will not work against viruses, as viruses reproduce inside cells. It is difficult to develop drugs that kill viruses without also damaging the body's tissues.

Antibiotic Resistance



To reduce the number of bacteria that are becoming resistant to antibiotics:

- Doctors need to avoid the overuse of antibiotics, prescribing.
- Antibiotics shouldn't be used in non-serious infections.
- Antibiotics shouldn't be used for viral infections.
- Patients need to finish the whole course of antibiotics so that all the bacteria are killed and none are left to mutate to resistant strains.

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Discovering Drugs

Traditionally drugs were extracted from plants or microorganisms. Most new drugs are synthesized by chemists in the pharmaceutical industry. However, the starting point may still be a chemical extracted from a plant.

- The heart drug digitalis originates from foxgloves.
- The painkiller aspirin originates from willow trees.
- Penicillin was discovered by Alexander Fleming from the penicillium mould.

Developing Drugs

New medical drugs must be tested and trialled before being used to check:

- If they are safe - toxicity
- If they work - efficacy
- How much should be given – dosage

The results of any testing are then **peer-reviewed** to make sure that the results are described accurately. The results would then be **published** in journals

Drug Trials

The 3 stages of drug development

Preclinical Testing

- The drug is tested on cells in the lab.
- Computer models may also be used to simulate the metabolic pathways that may be taken by the drug.
- **Efficacy** and **toxicity** are tested at this stage.

Whole organism testing

- The drug is tested on animals to see the effect in a whole organism – all new medicines in the UK have to have tests on 2 different animals by law.
- **Efficacy**, **toxicity** and **dosage** are tested at this stage.

Clinical trials

- The drug is tested on human volunteers first, generally with a very low dose then increased. This is to make sure it is safe in a body that is working normally.
- The next stage is to test on patients with the condition.
- The patients are often split into two groups; one given the drug the other given a **placebo**. This is called a **double-blind study** – neither the doctor nor the patient knows if the patient is getting the placebo or the active drug.
- Once the drug is found to be safe then the lowest effective dose is tested at this stage